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[redacted]

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[redacted] . . . . . [redacted]

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July 30, 1956

[redacted] (DL, RD 107) ILLEGIB

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[redacted]

Reference: Contract RD-107
Task Order No. 3
Req'n EH-78012

Dear Sir:

At a meeting held on July 24, 1956 at [redacted], [redacted] of your office posed several questions on the referenced program. Inasmuch as time did not permit adequate discussion, several of his queries are covered in the attached letter.

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If any further information is required do not hesitate to contact the undersigned.

Very truly yours,

[redacted]

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Army Contracts

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Reference: Req. Number 78012

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July 25, 1956

TO: Project Engineer, Ferrite Antenna Development Program

A meeting was held on 24 July 1956 between engineers of 25X1
and the Project Engineer of the Ferrite Antenna Development 25X1
Program who represented the contracting agency. Time did not permit a thorough discussion of several queries posed by the Project Engineer. We shall try to answer two of these queries at this time in letter form.

Phase A of the program involved the construction of 30 antennas based principally upon existing knowledge. No time or funds were alloted for any extensive materials development or materials evaluation program. However, numerous materials had previously been evaluated by 25X1
during the course of another program sponsored by company funds. These 25X1
investigations formed the principal basis for the choice of material for the present application. Information supplied by representatives of 25X1
served as a lesser basis. 25X1

The materials tested were 25X1
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The gain relative to a half-wave dipole for the 25X1
three best materials as reported by in an internal company publication 25X1
are tabulated below:

MATERIAL	GAIN		
	60 Mc/s	180 Mc/s	210 Mc/s
	- 0.4 db	- 0.6 db	- 0.7 db
	- 0.8	- 0.9	- 1.2
	- 0.6	- 0.5	- 1.5

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The data was gathered by calibrating the AGC of a VHF receiver. However, the measurements were taken without the advantage of a dark room, and the experimental error is likely to be large, perhaps as great as 0.5 db. More accurate measurements are planned as a part of Phase B. Meanwhile, the only conclusion that one could safely draw from the foregoing data is that the performance of the three materials is comparable.

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Another observation reported by [redacted] in the same report is that the gain differs for different samples of the same material. For example, two samples of [redacted] gave the following results. 25X1 25X1

Material	Gain		
	60 Mc/s	180 Mc/s	20 Mc/s
[redacted]	- 2.1 db	- 2.0 db	- 3.1 db
	- 0.6	- 0.5	- 1.5

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The Properties which are responsible for such non-uniformity are not known at this time, but the study which is proposed for Phase "B" is expected to yield information pertinent to this undesirable phenomenon.

[redacted] displayed greater uniformity of samples than did the other two materials, and it was this consideration which was responsible for the preference of the [redacted] material over [redacted]. 25X1 25X1 25X1 25X1

The second query raised by the Project Engineer was the possibility of achieving increased gain by decreasing the bandwidth of the ferrite antenna in some manner. The remainder of the letter discusses this possibility.

Chu, in his article in the December 1948 issue of JOURNAL OF APPLIED PHYSICS, discusses the gain and bandwidth of antennas designed for maximum gain-bandwidth product. The gain-bandwidth product was found to be limited by the size of the antenna, provided super-gain antennas are not considered. Super-gain antennas require very large amounts of energy stored in the near field compared to the amount of energy radiated. The ohmic losses in the antenna by currents required to establish the stored energy and the losses by induced currents in conducting objects near the antenna disallow super-gain antennas in practice.

The gain of an antenna designed for maximum gain-bandwidth product was found to decrease with physical size of the antenna, approaching a limiting value of -0.5 db below a half-wave dipole at very small sizes. Note that the gain of the ferrite antenna developed at the [redacted] very nearly achieves the gain of an antenna designed for a maximum gain-bandwidth product. However, the bandwidth over which this gain is achieved is much greater than would be allowed by Chu's results. We have attributed the increase in bandwidth to the properties of the ferrite material. Although the gain-bandwidth 25X1

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product of the antenna was increased, the gain of the antenna was not increased by the ferrite material; and indeed if it had been, a super-gain antenna would have resulted.

Similarly, any hopes of increasing the gain of the ferrite antenna by now decreasing its bandwidth would be a hope of achieving improved antenna performance by achieving a super-gain antenna. Even if the super-gain antenna were both practical and possible, its development would be lengthy and not suitable for inclusion in the type [illegible] presently engaged.

WHM:dik

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